Statistics 421/621 – Applied Time Series and Forecasting
Spring 2018

Lecture: TR 9:25-10:40am**,** DCH 1064
Discussion Session: TBA

Instructor: Dr. Kathy Ensor; x4687; ensor@rice.edu
Office Hours: Tuesday from 11 to noon

TA: TBA
Discussion Session Time: TBA

Course Objective: To educate students on the foundation and practical implementation of time series methods and forecasting. Examples will come primarily from a broad spectrum of problems in engineering, science, social science and business including financial applications.

Textbook: The main text for the course is:

- Time Series Analysis and Its Applications with R Examples by Shumway & Stoffer, 4th Edition. http://www.stat.pitt.edu/stoffer/tsa4/
- *Another free text on simple Forecasting: principles and practice by Rob J. Hyndman and George Athanasopoulos is found at https://www.otexts.org/fpp.* We will use this text at the beginning of the course while studying simple forecasting strategies.
- *In the past I have used: The Analysis of Financial Times Series* by Ruey Tsay, 3rd Edition (Data sets; errata). This is an excellent text that provides another perspective. There should be copies around.

Computing Required: This course will require a substantial amount of computing and data analysis, relying on the statistical software package R (https://www.r-project.org/) through RStudio (http://rstudio.org/). Associated with the text is the R package astsa. The tsa4 website has significant example code.

Assessment:

- 30% Midterm Exam 1 – in class closed book – February 21nd.
- 35% Final Exam 2 – in class closed book – Scheduled by Registrar
- 25% Quizzes and homework.
    - HW may be assigned but not graded.
    - When HW is not graded, HW assessment will come in the form of online quizzes related to the homework.
    - Some graded HW's will be pledged assignments. If not pledged you are free to discuss with others, but you must write up your own solutions.
    - There may also be in class quizzes and in class participation grades. These opportunities cannot be made up if missed.
- 10% **Individual** Data Analysis Project

    - Paper (7%) -- A report generated using RMarkdown that integrates discussion, analysis, data and code. Students will be required to use the provided template.
    - Speed talk (3%). April 16th and 18th – (we will start early to accommodate everyone)
- There will be additional exam and homework questions for STAT 621 students based on the assumption of graduate level background knowledge in statistics.

Problem Sessions: The TA will hold problem session(s) to review class material, review the use of R, and work through example problems. Time TBA.

Disabilities: I encourage any student with a disability that requires accommodation to let me know as well as Rice Disability Support Services.

Topics

- Characteristics of time series
    - Basic time series decomposition, smoothing and forecasting.
    - Stochastic process structure, notation, stationary process, temporal dependence and forecasting.
- Time series regression, exploratory data analysis, nonparametric smoothing
- Linear Time Series models
- State-Space Models
- Spectral Methods
- Additional Time Domain Topics: Unit root nonstationarity; GARCH models; Multivariate linear TS Models